MEASURING ENVIRONMENTAL VALUE IN NONMONETARY TERMS: A REVIEW

Richard Cole

Institute for Water Resources

U. S. Army Corps of Engineers

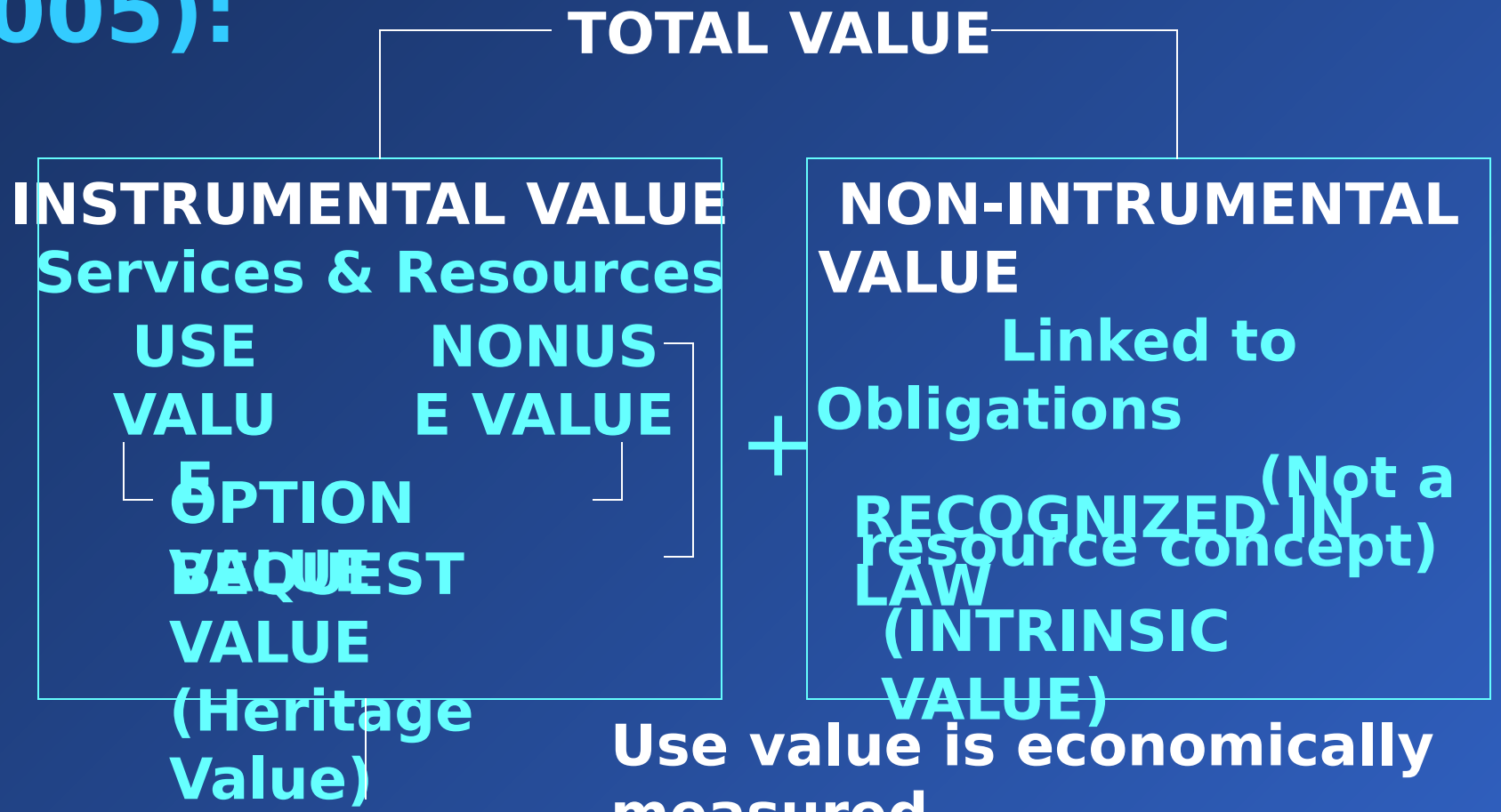
Background Issues:

- GPRA requires measurement of program progress in achievement
  - This includes environmental achievements
  - OMB prefers monetary measurement
- Most measurement has been non-monetary
- Different metrics have proliferated
- Metric relationship to value is often unclear
  - Confuses cooperation and coordination
  - Impedes achievement of national goals
- The Corps has long sought improved metrics
- This review was conducted for that purpose

Objectives: Review...

- Values classification
- Measurement of environmental value in government
- Measurement of environmental value in nongovernment
- Common elements of measurement

Value Classification (NRC 2005):



Use value is economically measured

Nonuse value is economically controversial-- Corps policy forbids

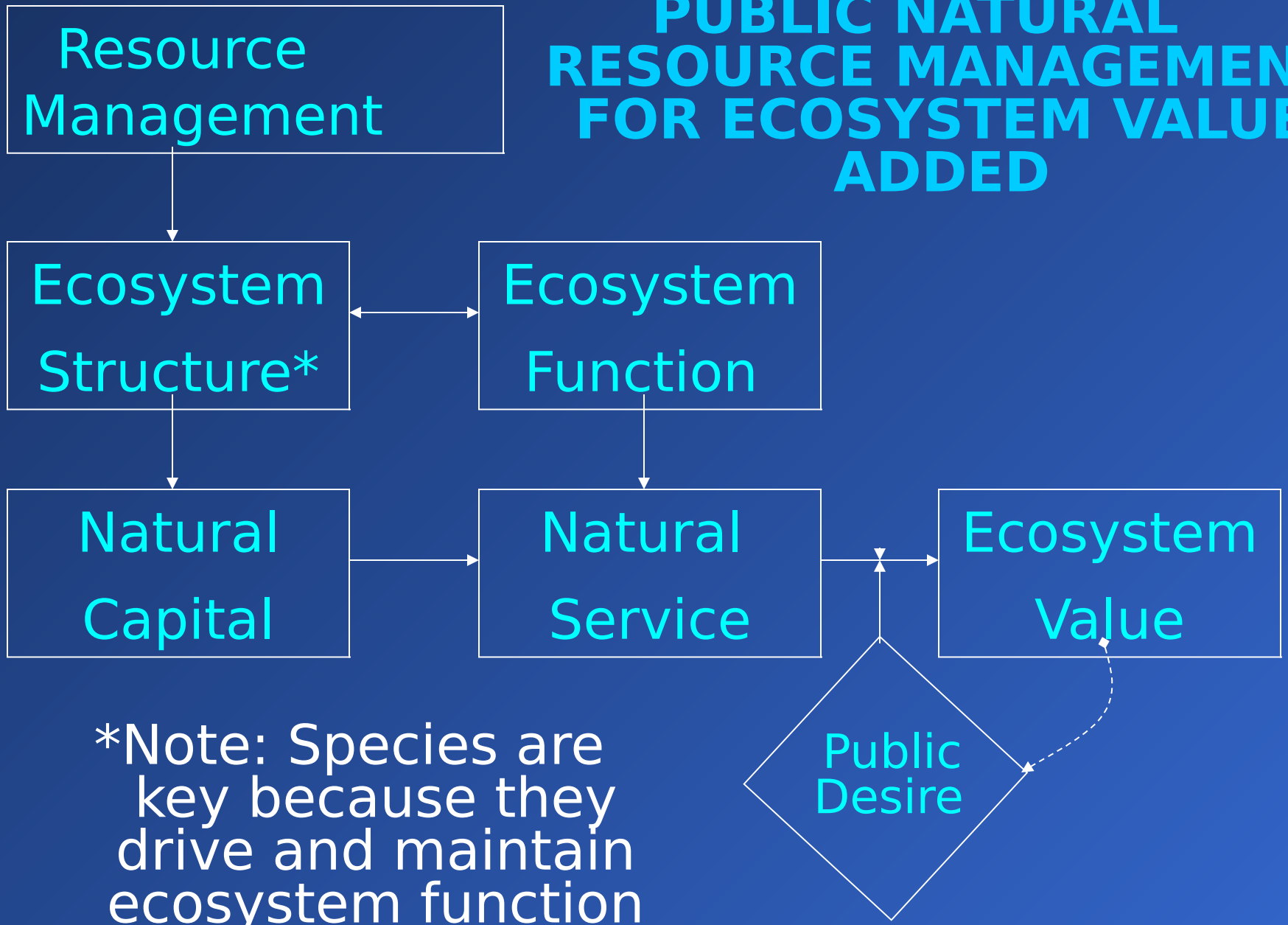
GOVERNMENT MEASUREMENT OF ENVIRONMENTAL VALUE:

- Most agency authority is programmatic
- Value is established in statuatory goals
  - Goals indicate public desire for more or better
  - Achievement is measured using diverse performance indicators
- Links between measure and value added are often unclear
- Typically includes an unsorted mix of use and nonuse values

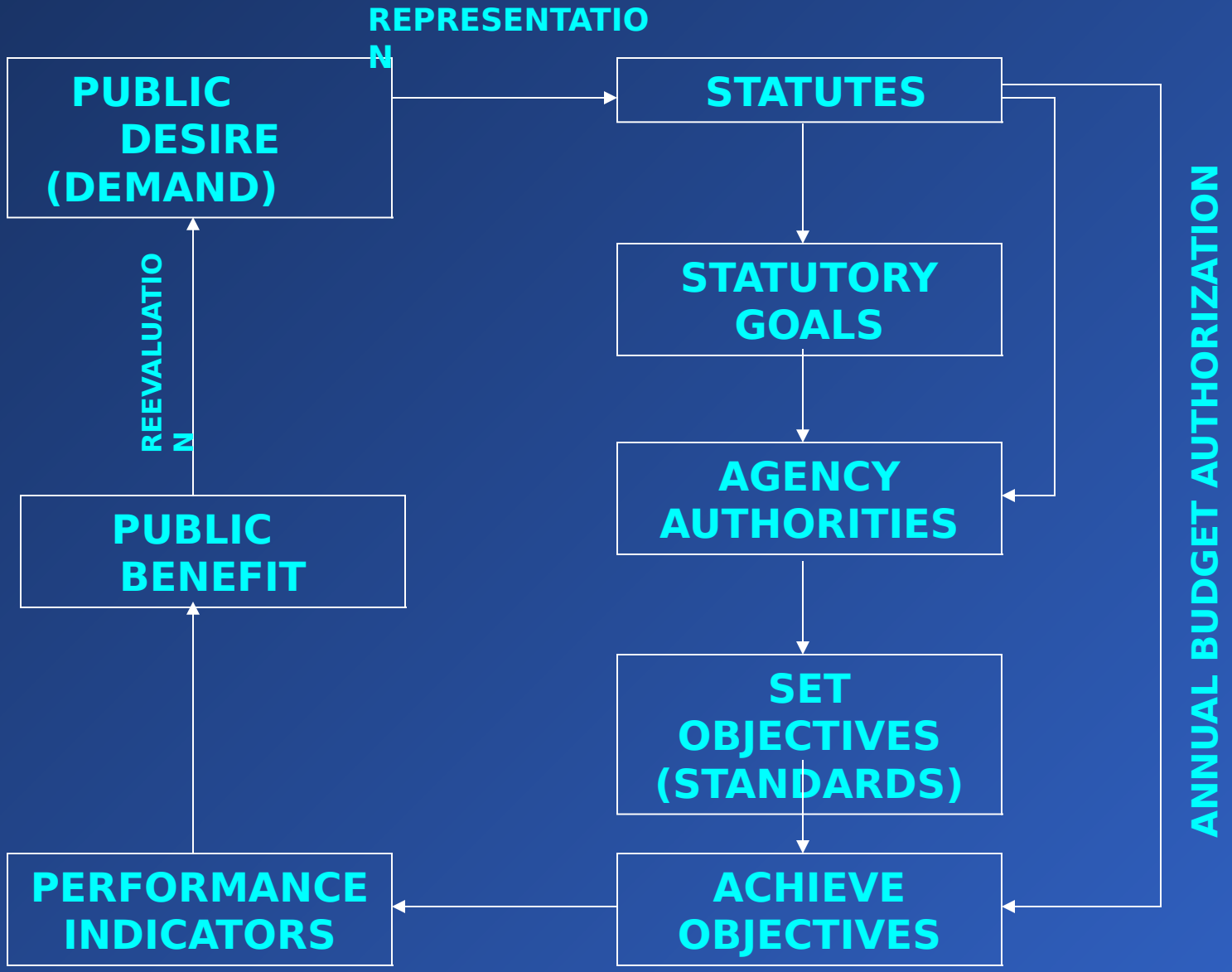
Recommended Indicators (NRC 2000)

- **Extent and Status Indicators**
  - Land cover
  - Land use
- **Ecological Capital**
  - Total species diversity
  - Native species diversity
  - Nutrient runoff
  - Soil organic matter
- **Ecological Functioning**
  - Carbon storage
  - Production capacity
  - Net primary production
  - Lake trophic status
  - Stream oxygen
  - Nutrient-use efficiency
  - Nutrient balance

PUBLIC NATURAL RESOURCE MANAGEMENT FOR ECOSYSTEM VALUE ADDED



*Note: Species are key because they drive and maintain ecosystem function



GOVERNMENT OBJECTIVE ACHIEVEMENT CYCLE

National Environmental Policy Act:

- Goal of beneficial development
- Goal of natural and cultural heritage protection
- Advises full compensation of replaceable resources
  - Advises compensation for lost use value
- Advises avoidance of irreplaceable resources
  - Advises their nonuse protection
  - Resource rarity (scarcity) is important
  - Resource distinction is important
  - Cumulative risk to resources is important

Endangered Species Act:

- Objective is to recover and sustain species viability
- One of the few laws that serves nonuse value
  - Natural heritage is an explicit consideration
  - Listing decisions are made based on biological criteria only—rarity, threats, distinction

Corps Ecosystem Restoration Planning Policy:

NER Objective Contributions:

- **Are valued changes in ecological resources**
- **Are not cultural, aesthetic or water quality**
- **Cannot be measured in monetary terms**
- **Are functions of habitat improvement**

Ecosystem Restoration Study Objective:

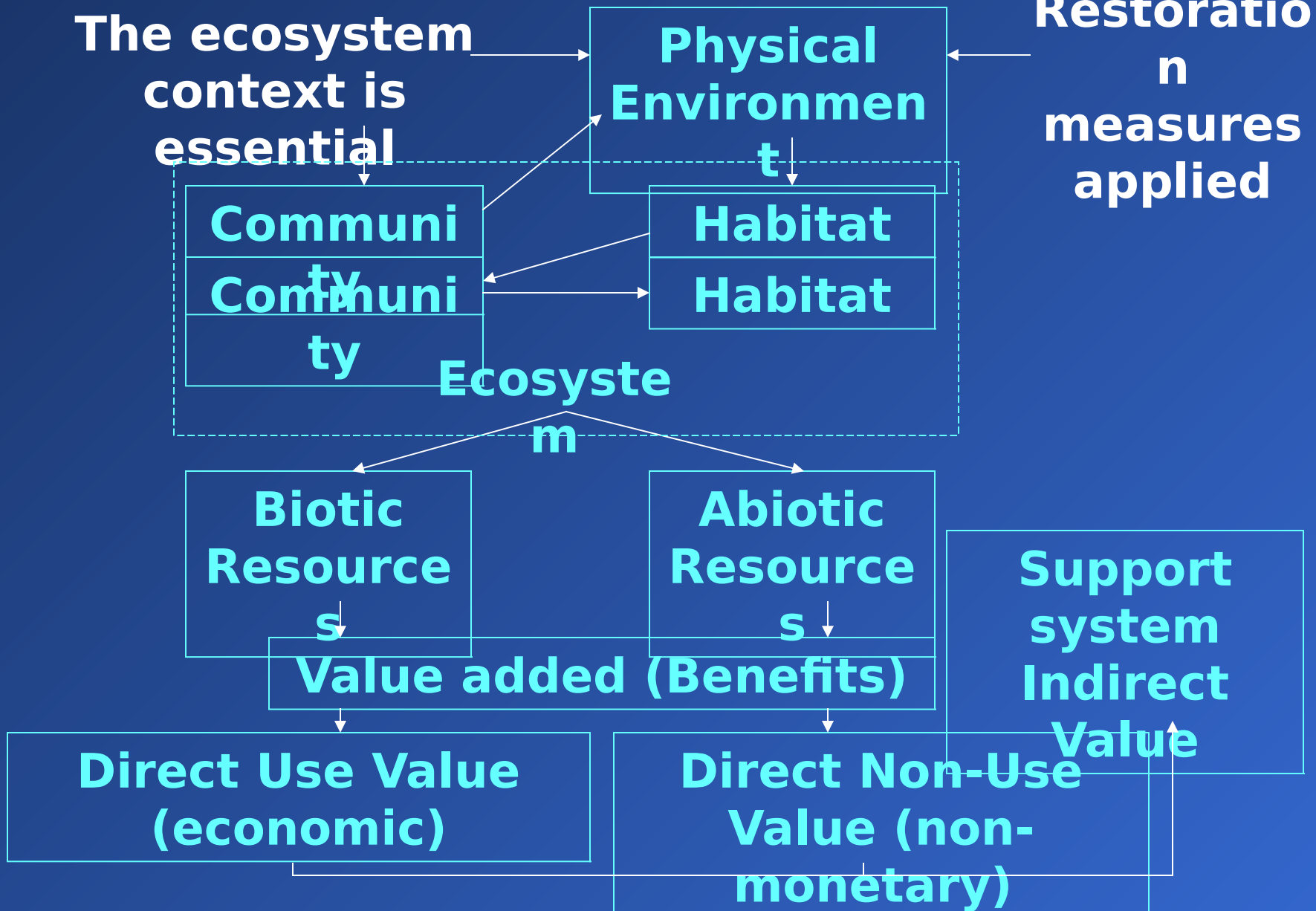
- **Contributions are desired outputs**
- **Restored via a more natural ecosystem state**
  - **Self-regulating and sustainable**
  - **With high biodiversity**
- **Targets "biologically desirable species" & native species**

Nonuse value cannot be measured in monetary terms

Measurement In The Corps:

- The justifying benefit must not be economic
- The benefits metric must apply across plans
- Different metrics are allowed among projects
- Many incommensurate metrics have been used
- The links from metrics to value are often unclear
- Cannot simply sum-up benefits across projects

Benefits Flow From Restoration:



Environmental NGOs:

- Value is determined by mission and bylaws
- These indicate membership's desired output
- These are translated into measurable objectives
- Many NGOs invest in a mix of use and nonuse value
- Biodiversity conservancies invest primarily in nonuse values

Conservation NGO Ranking Criteria:

- Rarity—basic; genes, species, ecosystems
- Threat—used when sources/trends known
- Distinctiveness—used when known
- Species Richness—used when rarity not known
- Representativeness—used with richness
- Function—keystone influence (for species focus)
- Utility— economic gain (for species focus)
- Feasibility (Cost)—basic; costs and risks.

Notes:
Ecosystems are identified by species composition
A security criterion combines rarity and threat

Two Common Approaches:

$$\text{Score} = \frac{R(D)(T)}{C}$$

Used where much knowledge, such as in the United States

$$\text{Score} = \frac{S(X)}{C}$$

Used where little knowledge, such as in equatorial areas

R = rarity of species in system (where data exist);

= ecosystem geographical area (where few data)

T = threat to species and ecosystem integrity

D= distinctiveness of species and ecosystem

CONCLUSIONS:

- Most environmental value is indicated in nonmonetary metrics
- Most indicators include values that can be measured in monetary terms
- The Corps must separate monetary and nonmonetary values
- The ESA, private conservancies and the Corps have natural heritage interest in common
- Resource scarcity, distinction (irreplaceable), risk of failure, and costs are common elements for determining value.